REMARKS

Reconsideration of the above-identified application, as amended, is respectfully requested.

In the Office Action of June 1, 2006, the Examiner rejected Claims 1, 2, 4, 5 and 18 under 35 U.S.C. §102(b), as being allegedly anticipated over Sugawara et al. (U.S. 5,438,421) ("Sugawara"). Further in the Office Action, the Examiner rejected Claims 6,7 and 9-11 under 35 U.S.C. §103(a), as being allegedly unpatentable over Sugawara in view of Bryan-Brown et al. (U.S. Patent No. 5,917,570) ("Bryan-Brown"). In the present Official Action, Claims 3 and 8 were further rejected based upon the combination of Sugawara in view of Callegari et al. (U.S. Patent No. 6,020,946)

In response to the rejection of independent Claim 1, Applicant amends Claim 1 to set forth a liquid crystal display (LCD) device comprising: a first substrate having a grooved surface profile; and, an alignment film layer of inorganic or organic material formed on said grooved surface and having said grooved surface profile, the alignment film of inorganic or organic material having 90° meta-stable alignment states eliminated at the surface of said alignment film layer and having an increased alignment force for constraining deposited LC material to a direction parallel to the grooves; and, a second substrate aligned opposite said first substrate for forming a plurality of LCD cells having the liquid crystal (LC) material deposited therein, wherein LC molecules align parallel to the grooves for enhanced LCD performance.

Applicants respectfully submit that the amendment to Claim 1 is distinct over the prior art and patentable thereover for the following reasons:

First, an amendment to Claim 1 is being made to remove any reference to a product-by-process or method step limitation ("being subject to an ion beam incident to said grooved surface in a direction parallel to a groove direction ..."). Thus, the distinguishing feature of the invention over the prior art is the fact that the surface of the alignment film layer has 90° meta-stable alignment states eliminated and that the alignment film layer has an increased alignment force for constraining deposited LC material (thus further removing any reference to an "intended use" limitation as the Examiner indicated). Respectfully, no new matter is being entered by this amendment with full support found in the specification.

With respect to the rejection of Claim 1 as being anticipated by Sugawara, applicants respectfully disagree.

Claim 1 recites the LCD device structure including an alignment film layer having 90° meta-stable alignment states eliminated (a structural limitation). Sugawara does not teach nor suggest provision of an alignment film layer structure having 90° meta-stable alignment states eliminated. While the orientation film layer 20 in Fig. 5(e) of Sugawara has a grooved surface, by virtue of it taking on the surface profile resulting from the prior etch step in Fig. 5(c), this alone does not render the layer having 90° meta-stable alignment states eliminated. The present invention has achieved this elimination of 90° meta-stable alignment states by virtue of its subjecting the alignment film layer itself to ion beam irradiation in the embodiment described.

Respectfully, contrary to the Examiner's determination, the alignment film layer in Sugawara is shown as element 20 in Fig. 5(e) as the "coating of orientation film". While the orientation layer is grooved in Sugawara, there is no teaching or suggestion that this coating of orientation film in Sugawara has 90° meta-stable alignment states eliminated -primarily for the reason that Sugawara does neither discloses nor suggests a further treatment of the

orientation film layer that would result in the elimination of 90° meta-stable alignment states at the surface, unlike in the present invention. While the Examiner has likened the ion-beam etching shown in Fig. 5(c) of Sugawara as etching an alignment layer, applicants respectfully submit that the Examiner's understanding is misplaced. There is no orientation layer in Sugawara that is subject to any type of treatment that would render 90° meta-stable alignment states eliminated at its surface. Moreover, contrary to the Examiner's citation of Sugawara (Fig. 5(c), col. 11, line 55), the arrows indicated in Figure 5(c) of Sugawara indicate ion beam treatment perpendicular to a grooved direction, for the purposes of surface etching, i.e., tailoring a surface so to provide an irregularity as shown in a cross-section view of Figure 5(c). The ion beam etching of Sugawara is to create a grooved substrate or underlayer beneath the alignment layer 5(c), the alignment layer is coated on top of the ion beam etched surface in subsequent steps 5(e). In the current application, the ion beam irradiaton is directly on the alignment layer to create the liquid crystal alignment. Claim 18 clearly describes an ion beam application to the alignment film layer in a direction parallel to the groove direction in order to avoid weak anchoring and 90 degree meta-stable states in liquid crystal (LC) material resulting in said increased alignment force.

For these reasons, the Examiner is respectfully requested to withdraw the rejection of Claim 1 as allegedly anticipated by Sugawara, and further to withdraw the rejections of claims 2, 4 5 and 18 by virtue of their dependency upon Claim 1. Claim 18 in particular is being amended to conform with the amendments to Claim 1.

Respectfully, the application of Bryan-Brown does not remedy the deficiencies of Sugawara. While Bryan-Brown teaches altering the grooved profile by using a bigrating technique, i.e., light exposing an alignment layer to both asymmetric and symmetric gratings to achieve a particular pre-tilt of about 5-15° for nematic LC materials (See Bryan-Brown at

col. 3, lines 64-67), nowhere is there a suggestion in Bryan-Brown that the surface alignment layer has 90° meta-stable alignment states eliminated at the surface, unlike as claimed in the present invention. The purpose of the Bryan-Brown's bigrating groove is to force the rod-like liquid crystal molecules follow the contours of the grating or grooves, i.e., the long axis of the liquid crystal molecules are lie in the plane that is perpendicular to the grooves as shown in Figs. 5A and 5B of Bryan-Brown. Due to the nature of the grooves as a result of application of the Bryan-Brown's technique, a 90 degree meta-stable state exists that is parallel to the groove. In current application, the long axis of the liquid crystal molecule is parallel to the grooves and the 90 degree meta-stable state that has long axis of liquid crystal molecules perpendicular to the grooves has been eliminated. That is, the desired alignment direction in Bryan-Brown's case is 90 degree from the desired alignment direction in the present application, relative to the direction of the grooves. In Bryan-Brown's case, a 90 degree metastable state exist as well, but this meta-stable state is parallel to the grooves since the preferred alignment direction in Bryan-Brown's case is perpendicular to the grooves.

As a final remark, while inherently any ion beam etching will alter characteristics of a material at a microscopic level, the present invention recognizes the advantageous results from a prior Ion Beam treatment of the alignment film layer that is incident to a grooved surface in a direction parallel to a groove direction which thereby eliminates 90° meta-stable alignment states at the surface of said alignment film layer resulting in an increased alignment force for constraining deposited LC material to a direction parallel to the grooves. Thus, it is respectfully submitted, there is a structural difference at the microscopic level that is neither taught nor suggested by Sugawara whether taken alone or in combination with Bryan-Brown or Calligari. That is, the combination of the prior art teachings do not teach or suggest a LCD

device having an alignment film layer having a grooved surface profile with 90° meta-stable alignment states eliminated.

In view of the foregoing remarks herein, it is respectfully submitted that this application is in condition for allowance. Accordingly, it is respectfully requested that this application be allowed and a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the Applicants' attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,

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